Phenomena Based Process Intensification of Toluene Methylation for Sustainable Para-xylene Production - DTU Orbit (09/11/2017)

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The objective of this work is to generate more sustainable intensified process designs for the production of important chemicals in the petrochemical sector. A 3-stage approach is applied. In stage 1, the base case design is generated or selected from literature. In stage 2, the base case design is analysed in terms of economics, sustainability and LCA factors in order to identify process hot-spots that are translated into design targets. In stage 3, intensified flowsheet alternatives are generated that match the targets and thereby eliminate and/or minimize the process hot-spots using a phenomena based method. Here, the flowsheet is decomposed into unit operations, tasks and phenomena that are analysed and selected in order to increase driving forces related to, for example, reaction and separation. The phenomena are then re-combined to fulfil tasks that are translated into intensified unit operations to generate more sustainable designs. An overview of the key concepts and framework are presented together with the results from a case study highlighting the application of the framework to the sustainable design of a production process for para-xylene, which is an important chemical utilized in the production of polymers such as polyesters.

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